CLAIMS

1. A tomosynthesis method for creating a three-dimensional reconstruction of a target element comprising:

acquiring radiation absorbance images of the target element through a limited plurality of angles; and

applying an iterative reconstruction algorithm to generate the three-dimensional reconstruction of the target element;

wherein the iterative reconstruction algorithm is applied using cone-beam forward projection and back projection.

2. A method according to claim 1, wherein the radiation absorbance images are acquired by transmitting x-ray energy from an x-ray source through the target element to an x-ray detector.

3. A method according to claim 2, wherein the x-ray detector is a digital x-ray detector having a plurality of detector pixels.

4. A method according to claim 1, wherein radiation absorbance images are acquired through a number of angles that is less than or equal to about 100.

5. A method according to claim 1, wherein radiation absorbance images are acquired through a range of angles that is between about 30 and 120 degrees.

6. A method according to claim 1, wherein the iterative reconstruction algorithm is a maximum likelihood algorithm.

7. A method according to claim 3, wherein the three-dimensional reconstruction of the target element is represented as an array of voxels having a uniform or non-uniform size in three-dimensions.

8. A method according to claim 7, wherein a forward projection step is implemented by ray tracing from the x-ray source to a detector pixel and the forward projection of the target element is obtained by repeating the ray tracing for each detector pixel to calculate an attenuation value for each voxel.

9. A method according to claim 8, wherein a back projection step is implemented by locating detector pixels containing attenuation information relating to a selected voxel and using those pixels to update the attenuation value of the selected voxel.

10. A method according to claim 9, wherein the back projection step includes performing a back projection for at least each voxel corresponding to a three-dimensional reconstruction of the target element.

11. A method according to claim 6, wherein the maximum-likelihood estimation is implemented using an expectation-maximization algorithm.

12. A method according to claim 1, wherein the target element is at least a portion of a human patient.

13. A method according to claim 12, wherein the target element is a breast of a female human patient.

14. A method according to claim 1, wherein the number of iterations is less than or equal to about 10.

15. A system for three-dimensional tomosynthesis imaging of a target element comprising:

an image acquisition element for obtaining a plurality of images of the target element from a plurality of angles having:

a radiation source positionable at a plurality of angles with respect to the target element; and

a radiation detector positioned so as to detect radiation emitted by the radiation source passing through the target element and determine a plurality of attenuation value for radiation passing through the target element to establish a radiation absorbance projection image of the target element for a particular radiation source angle; and

a processor configured to apply an iterative reconstruction algorithm to the radiation absorbance projection images of the target element obtained from a plurality of radiation source angles to generate a three-dimensional reconstruction of the target element wherein the iterative reconstruction algorithm is applied using cone-beam forward projection and back projection.

16. A system according to claim 15, wherein the radiation detector is a digital x-ray detector having a plurality of detector pixels.

17. A system according to claim 15, wherein radiation absorbance projection images are acquired through a number of angles that is less than or equal to about 100.

18. A system according to claim 15, wherein radiation absorbance projection images are acquired through a range of angles that is between about 30 and 120 degrees.

19. A system according to claim 15, wherein the iterative reconstruction algorithm is a maximum likelihood algorithm.

20. A system according to claim 16, wherein the three-dimensional reconstruction of the target element is represented as an array of voxels having a uniform or non-uniform size in three-dimensions.

21. A system according to claim 20, wherein a forward projection step is implemented by ray tracing from the radiation source to a detector pixel and the forward projection of the target element is obtained by repeating the ray tracing for each detector pixel to calculate an attenuation value for each voxel.

22. A system according to claim 21, wherein a back projection step is implemented by locating detector pixels containing attenuation information relating to a selected voxel and using those pixels to update the attenuation value of the selected voxel.

23. A system according to claim 22, wherein the back projection step includes performing a back projection for at least each voxel corresponding to a three-dimensional reconstruction of the target element.

24. A system according to claim 19, wherein the maximum-likelihood estimation is implemented using an expectation-maximization algorithm.

25. A computer program for three-dimensional tomosynthesis imaging of a target element from a plurality of radiation absorbance projection images obtained at a different angles from an image acquisition element having a radiation source positionable at a plurality of angles with respect to the target element and a radiation detector positioned so as to detect radiation emitted by the radiation source passing through the target element and determine a plurality of attenuation value for radiation passing through the target element to establish a radiation absorbance projection image of the target element for a particular radiation source angle, the computer program code being embodied in a computer readable medium and comprising:

computer program code for applying an iterative reconstruction algorithm to the radiation absorbance projection images of the target element obtained from a plurality of radiation source angles to generate the three-dimensional reconstruction of the target element wherein the iterative reconstruction algorithm is applied using cone-beam forward projection and back projection.

26. A computer program according to claim 25, wherein the radiation detector is a digital x-ray detector having a plurality of detector pixels.

27. A computer program according to claim 25, wherein radiation absorbance projection images are acquired through a number of angles that is less than or equal to about 100.

28. A computer program according to claim 25, wherein radiation absorbance projection images are acquired through a range of angles that is between about 30 and 120 degrees.

29. A computer program according to claim 25, wherein the iterative reconstruction algorithm is a maximum likelihood algorithm.

30. A computer program according to claim 26, wherein the three-dimensional reconstruction of the target element is represented as an array of voxels having a uniform or non-uniform size in three-dimensions.

31. A computer program according to claim 30, wherein a forward projection step is implemented by ray tracing from the radiation source to a detector pixel and the forward projection of the target element is obtained by repeating the ray tracing for each detector pixel to calculate an attenuation value for each voxel.

32. A computer program according to claim 31, wherein a back projection step is implemented by locating detector pixels containing attenuation information relating to a selected voxel and using those pixels to update the attenuation value of the selected voxel.

33. A computer program according to claim 32, wherein the back projection step includes performing a back projection for at least each voxel corresponding to a three-dimensional reconstruction of the target element.

34. A computer program according to claim 29, wherein the maximum-likelihood estimation is implemented using an expectation-maximization algorithm.